



General

Guideline Title

Practice advisory for the prevention of perioperative peripheral neuropathies. An updated report by the American Society of Anesthesiologists Task Force on Prevention of Perioperative Peripheral Neuropathies.

Bibliographic Source(s)

American Society of Anesthesiologists Task Force on Prevention of Perioperative [trunc]. Practice advisory for the prevention of perioperative peripheral neuropathies: an updated report by the American Society of Anesthesiologists Task Force on prevention of perioperative peripheral neuropathies. *Anesthesiology*. 2011 Apr;114(4):741-54. [79 references] [PubMed](#)

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

I. Preoperative History and Physical Assessment

- When judged appropriate, it is helpful to ascertain that patients can comfortably tolerate the anticipated operative position.§

II. Specific Positioning Strategies for the Upper Extremities

- Arm abduction in supine patients should be limited to 90°.
- Patients who are positioned prone may comfortably tolerate arm abduction greater than 90°.
- Supine Patient with Arm on an Arm Board
 - The upper extremity should be positioned to decrease pressure on the post condylar groove of the humerus (ulnar groove).
 - Either supination or the neutral forearm positions facilitates this action.
- Supine Patient with Arms Tucked at Side
 - The forearm should be in a neutral position.
 - Flexion of the elbow may increase the risk of ulnar neuropathy, but there is no consensus on an acceptable degree of flexion during the perioperative period.
 - Prolonged pressure on the radial nerve in the spiral groove of the humerus should be avoided.
 - Extension of the elbow beyond the range that is comfortable during the preoperative assessment may stretch the median nerve.
 - Periodic perioperative assessments may ensure maintenance of the desired position.

III. Specific Positioning Strategies for the Lower Extremities

- Stretching of the Hamstring Muscle Group

- Positions that stretch the hamstring muscle group beyond the range that is comfortable during the preoperative assessment may stretch the sciatic nerve.
- Limiting Hip Flexion
 - Because the sciatic nerve or its branches cross both the hip and the knee joints, extension and flexion of these joints, respectively, should be considered when determining the degree of hip flexion.
 - Neither extension nor flexion of the hip increases the risk of femoral neuropathy.
 - Prolonged pressure on the peroneal nerve at the fibular head should be avoided.

IV. Protective Padding

- Padded Arm Boards
 - Padded arm boards may decrease the risk of upper extremity neuropathy.
- Chest Rolls
 - The use of chest rolls in the laterally positioned patient may decrease the risk of upper extremity neuropathy.
- Padding at the Elbow
 - Padding at the elbow may decrease the risk of upper extremity neuropathy.
- Padding to Protect the Peroneal (Fibular) Nerve
 - The use of specific padding to prevent pressure of a hard surface against the peroneal nerve at the fibular head may decrease the risk of peroneal neuropathy.
- Complications from the Use of Padding
 - The inappropriate use of padding (e.g., padding too tight) may increase the risk of perioperative neuropathy.

V. Equipment

- The use of properly functioning automated blood pressure cuffs on the arm (i.e., placed above the antecubital fossa) does not change the risk of upper extremity neuropathy.
- The use of shoulder braces in a steep head-down position may increase the risk of perioperative neuropathies.

VI. Postoperative Assessment

- A simple postoperative assessment of extremity nerve function may lead to early recognition of peripheral neuropathies.

VII. Documentation

- Documentation of specific perioperative positioning actions may be useful for continuous improvement processes and may result in improvements by: (1) helping practitioners focus attention on relevant aspects of patient positioning and (2) providing information on positioning strategies that eventually leads to improvements in patient care.

§Body habitus, preexisting neurologic symptoms, diabetes, peripheral vascular disease, alcohol dependence, arthritis, and gender (e.g., male gender and its association with ulnar neuropathy) are important elements of a preoperative history.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Peripheral neuropathies

Guideline Category

Evaluation

Management

Prevention

Clinical Specialty

Anesthesiology

Neurology

Nursing

Surgery

Intended Users

Advanced Practice Nurses

Allied Health Personnel

Health Care Providers

Nurses

Physician Assistants

Physicians

Guideline Objective(s)

- To educate American Society of Anesthesiologists (ASA) members
- To provide a reference framework for individual practices
- To stimulate the pursuit and evaluation of strategies that may prevent or reduce the frequency of occurrence or minimize the severity of peripheral neuropathies that may be related to perioperative positioning of patients

Target Population

Adult patients who are or have been sedated or anesthetized for surgery

Note: This Advisory specifically focuses on perioperative positioning of the adult patient, use of protective padding, and avoidance of contact with hard surfaces or supports that may apply direct pressure on susceptible peripheral nerves. This Advisory does not focus on compartment syndromes or neuropathies that may be associated with anesthetic techniques (e.g., spinal anesthesia).

Interventions and Practices Considered

1. Preoperative history and physical assessment
2. Specific positioning strategies
 - Upper extremities
 - Lower extremities
3. Protective padding
 - Padded arm boards
 - Chest rolls
 - Padding at the elbow
 - Padding to protect the peroneal (fibular) nerve
4. Equipment
 - Automated blood pressure cuffs
 - Shoulder braces
5. Postoperative assessment of extremity nerve function
6. Documentation of specific perioperative positioning actions

Major Outcomes Considered

Incidence of perioperative peripheral neuropathy, including:

- Paresthesias
- Muscle weakness
- Tingling or pain in the extremities

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

State of the Literature

For this updated Advisory, a review of studies used in the development of the original Advisory was combined with a review of studies published subsequent to approval of the original Advisory. The updated literature review was based on evidence linkages, consisting of directional statements about relationships between specific positioning strategies and perioperative peripheral neuropathy. The evidence linkage interventions are listed as follows.*

I. Preoperative History and Physical Assessment

- A. A focused preoperative history and physical assessment

II. Specific Positioning Strategies for the Upper Extremities

- A. Brachial plexus neuropathy
 1. Abduction of 90° or less versus greater than 90°
 2. Supination of forearm versus pronation (and its subsequent effect on rotation of the humerus)
- B. Ulnar neuropathy at the elbow
 1. Flexion/extension of the elbow of 90° or less versus greater than 90°
 2. Patient in the supine position
 3. Forearm on an arm board: supination versus pronation of the forearm
 4. Arms tucked at the side: supination versus pronation of the forearm
- C. Radial neuropathy in the arm
 1. Avoidance of pressure on arm from contact with hard surfaces
- D. Median neuropathy at the elbow
 1. Patient in supine position
 - a. Flexion/extension of the elbow of 90° or less versus greater than 90°

III. Specific Positioning Strategies for the Lower Extremity

- A. Sciatic neuropathy
 1. Stretching of the hamstring muscle (e.g., biceps femoris muscle) beyond a comfortable range of motion
 2. Hip flexion of 120° or less versus greater than 120°
- B. Femoral neuropathy
 1. Hip flexion of 90° or less
- C. Peroneal (fibular) neuropathy
 1. Avoidance of contact with hard surfaces or supports that apply direct pressure on the fibular head
 2. Avoidance of contact with hard surfaces or supports that apply direct pressure on the lateral tibia

IV. Protective Padding

A. Upper extremity

1. Padded arm boards
2. Specific padding (e.g., foam or gel pads) at the elbow
3. For a patient in a lateral position, the use of a chest roll positioned under the chest (vs. a chest roll placed under the axilla) to protect the brachial plexus
4. Avoidance of padding that is excessively tight or restrictive (e.g., on the elbow)

B. Lower extremity

1. Specific padding between the outside of the leg below the knee to prevent contact of the peroneal nerve (at the fibular head) with a hard surface
2. Avoidance of padding that is excessively tight or restrictive

V. Equipment

A. Placed in the upper extremity

1. Use of shoulder braces (commonly placed over the acromioclavicular joint) to prevent a patient from sliding cephalad when placed in a steep head-down position

B. Blood pressure cuff

1. Automated blood pressure cuff (vs. manual blood pressure cuff monitoring)
2. Blood pressure cuff placed on the arm (vs. blood pressure cuff placed on the forearm)
3. Placed on the lower extremity
 - a. Avoidance of contact with hard surfaces or supports that apply direct pressure on the fibular head
 - b. Avoidance of contact with hard surfaces or supports that apply direct pressure on the lateral tibia

VI. Postoperative Assessment

- A. Postoperative physical assessment to detect peripheral neuropathies.

VII. Documentation

- A. Documentation of specific perioperative positioning actions to improve patient care.

For literature review, potentially relevant clinical studies were identified via electronic and manual searches of the literature. The updated electronic search covered a 12-yr period from 1999 through 2010. The manual search covered a 21-yr period from 1990 through 2010. More than 50 new citations that addressed topics related to the evidence linkages were initially identified. These articles were reviewed and combined with pre-1999 articles used in the original Advisory, resulting in 86 articles that contained direct linkage-related evidence. No evidence linkage contained sufficient literature with well-defined experimental designs and statistical information to conduct an analysis of aggregated studies (i.e., a meta-analysis). A complete bibliography used to develop this updated Advisory, organized by section, is available as Supplemental Digital Content 2, <http://links.lww.com/ALN/A663> .

*Unless otherwise specified, outcomes for the listed interventions refer to the occurrence of peripheral neuropathy.

Number of Source Documents

More than 50 new citations that addressed topics related to the evidence linkages were initially identified. These articles were reviewed and combined with pre-1999 articles used in the original Advisory, resulting in 86 articles that contained direct linkage-related evidence.

Methods Used to Assess the Quality and Strength of the Evidence

Expert Consensus

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Preparation of this update used the same methodological process as was used in the original Advisory to obtain new scientific evidence. Opinion-based evidence obtained from the original Advisory is reported in this update. The protocol for reporting each source of evidence is further described.

Scientific Evidence

Study findings from published scientific literature were aggregated and are reported in summary form by evidence category, as described later. All literature (e.g., randomized controlled trials, observational studies, and case reports) relevant to each topic was considered when evaluating the findings. However, for reporting purposes in this document, only the highest level of evidence (i.e., level 1, 2, or 3 within category A, B, or C) is included in the summary.

Category A: Supportive Literature

Randomized controlled trials report statistically significant ($P < 0.01$) differences between clinical interventions for a specified clinical outcome.

Level 1. The literature contains multiple randomized controlled trials, and the aggregated findings are supported by meta-analysis.*

Level 2. The literature contains multiple randomized controlled trials, but there is an insufficient number of studies to conduct a viable meta-analysis.

Level 3. The literature contains a single randomized controlled trial.

Category B: Suggestive Literature

Information from observational studies permits inference of beneficial or harmful relationships among clinical interventions and clinical outcomes.

Level 1. The literature contains observational comparisons (e.g., cohort and case-control research designs) of clinical interventions or conditions and indicates statistically significant differences between clinical interventions for a specified clinical outcome.

Level 2. The literature contains noncomparative observational studies with associative (e.g., relative risk or correlation) or descriptive statistics.

Level 3. The literature contains case reports.

Category C: Equivocal Literature

The literature cannot determine whether there are beneficial or harmful relationships among clinical interventions and clinical outcomes.

Level 1. Meta-analysis did not find significant differences among groups or conditions.

Level 2. The number of studies is insufficient to conduct meta-analysis. In addition, (1) randomized controlled trials have not found significant differences among groups or conditions, or (2) randomized controlled trials report inconsistent findings.

Level 3. Observational studies report inconsistent findings or do not permit inference of beneficial or harmful relationships.

Category D: Insufficient Evidence from Literature

The lack of scientific evidence in the literature is described by using the terms described below.

Silent. No identified studies address the specified relationships among interventions and outcomes.

Inadequate. The available literature cannot be used to assess relationships among clinical interventions and clinical outcomes. The literature either does not meet the criteria for content, as defined in the "Focus" of the Advisory, or does not permit a clear interpretation of findings because of methodological concerns (e.g., confounding in study design or implementation).

Opinion-based Evidence

The original Advisory contained formal survey information collected from expert consultants and a random sample of members of the American Society of Anesthesiologists (ASA). Additional information was obtained from open-forum presentations and other invited and public sources. All opinion-based evidence relevant to each topic (e.g., survey data, open-forum testimony, Internet-based comments, letters, and editorials) was considered in the development of the original Advisory. Survey responses from task force-appointed expert consultants are reported in summary form in the text, with a listing of consultant survey responses reported in appendix 2. In addition, survey responses from active ASA members are reported in summary form in the text, with a listing of survey responses reported in appendix 2 of the original guideline document.

*Practice Advisories lack the support of a sufficient number of adequately controlled studies required to conduct an appropriate meta-analysis. Therefore, category A1 evidence is not reported in this document.

Methods Used to Analyze the Evidence

Other

Review of Published Meta-Analyses

Systematic Review

Description of the Methods Used to Analyze the Evidence

A study or report that appears in the published literature can be included as evidence in the development of an Advisory if it meets four essential criteria. Failure to meet one or more of these criteria means that a study had features that did not make it suitable for analytic purposes. The four essential criteria are as follows: (1) The study must be related to one of the specified linkage statements. (2) The study must report a clinical finding or set of findings that can be tallied or quantified. This criterion eliminates reports that only contain opinion. (3) The study must report a clinical finding or set of findings that can be identified as the product of an original investigation or report. This criterion eliminates the repetitive reporting and counting of the same results, which may occur in review articles or follow-up studies that summarize previous findings. (4) The study must use sound research methods and analytical approaches that provide a clear test or indication of the relationship between the intervention and outcome of interest. Because of the few studies meeting all four criteria, the published literature could not be used as a source of quantitative support.

In conclusion, the current literature has not been helpful in determining the efficacy of perioperative positioning techniques in reducing the occurrence of peripheral neuropathies. Until additional controlled studies are conducted, evidence from other sources will need to be used, such as consensus-driven data and the opinion of practitioners and experts. It is recommended that future research on positioning techniques for the prevention of peripheral neuropathies focuses on improving research design and methods by concentrating on single interventions and recognizing confounding influences on outcomes (e.g., type or duration of surgery may influence the incidence or severity of perioperative peripheral neuropathies independent of patient position).

Consensus-based Evidence

For the original Advisory, consensus was obtained from multiple sources, including the following: (1) survey opinion from consultants who were selected based on their knowledge or expertise in perioperative positioning and peripheral neuropathy, (2) survey opinions from a randomly selected sample of active members of the American Society of Anesthesiologists (ASA), (3) testimony from attendees of a publicly held open forum at a national convention, (4) Internet commentary, and (5) task force member opinion and interpretation. The rate of return was 56.0% (84/150) for consultants and 28.9% (433/1,500) for membership respondents. Results of the original surveys are reported in tables 1–3 and in the text of the original Advisory document.

The majority of consultants and ASA membership respondents agreed with the following survey items: (1) a focused preoperative medical history and a focused preoperative examination to identify patients at risk for the development of peripheral neuropathies during the perioperative period; (2) upper extremity position should be periodically assessed during procedures; (3) limiting abduction of the arm(s) in a supine or prone patient may decrease the risk of brachial plexus neuropathy; (4) specific forearm position(s) in a supine patient with arm(s) tucked at the side or abducted on an arm board may decrease the risk of ulnar neuropathy; (5) pressure in the spiral groove of the humerus from prolonged contact with a hard surface may increase the risk of radial neuropathy; (6) extension of the elbow in an anesthetized supine patient beyond the normal range of extension that is comfortable during the preoperative examination may increase the risk of median neuropathy; (7) pressure near the fibular head from contact with a hard surface or a rigid support may increase the risk of peroneal neuropathy; (8) padded arm boards may decrease the risk of upper extremity neuropathies; (9) a chest roll placed under the "downside" (dependent) lateral thorax in a patient who is positioned laterally may decrease the risk of brachial plexus neuropathy in the down arm; (10) specific padding (e.g., foam or gel pads) at the elbow may decrease the risk of ulnar neuropathy; (11) specific padding to prevent contact of the peroneal nerve (at the fibular head) with a hard surface may decrease the risk of peroneal neuropathy; (12) in some circumstances, the use of padding may increase the risk of peripheral neuropathies; (13) shoulder braces (commonly placed over the acromioclavicular joint) to prevent a patient from sliding cephalad when placed in a steep head-down position may increase the risk of brachial plexus neuropathy; (14) examining the patient in the postanesthesia care unit (PACU) may lead to early recognition of peripheral neuropathy; and (15) documentation on an anesthetic record of specific positioning actions during the care of a patient is important. Items for which no majority agreement was indicated were as follows: (1) flexion of the elbow may increase the risk of ulnar neuropathy; (2) stretching of the hamstring muscle group (e.g., biceps femoris muscle) beyond the normal range of motion that is comfortable during the preoperative assessment may increase the risk of sciatic neuropathy; (3) extension of the hip in an anesthetized supine patient beyond the normal range of extension that is comfortable during the preoperative examination (e.g., hyperlordosis) may increase the risk of femoral neuropathy; and (4) the use of an automated blood pressure cuff on the arm may increase the risk of ulnar, radial, or median neuropathy.

Consultants and ASA membership respondents who agreed with the previously described survey items responded to specific item-related topics. Most of these respondents agreed with the following items: (1) preexisting patient attributes that are important to review during a preoperative history include, but are not limited to, body habitus, preexisting neurologic symptoms, diabetes, peripheral vascular disease, alcohol dependence, and arthritis; (2) during a patient examination, it is important to assess limitations to joint range of motion in the elbow and/or shoulder, range of motion of an arthritic neck, range of motion of the hip and knee joints (for placing patients in a lateral or lithotomy position), ability to extend hips (for placing patients in a supine position), and flexibility of the hamstring muscle group (for placing patients in a lateral or lithotomy position); (3) the upper limit of abduction of the arm(s) in a supine or prone patient should be 90°; (4) in a supine patient with arm(s) tucked at the side, the forearm in the neutral position may decrease the risk of ulnar neuropathy; (5) in a supine patient with arm(s) abducted on an arm board, the forearm in the supinated position may decrease the risk of ulnar neuropathy; (6) elbow flexion of greater than 90° may increase the risk of ulnar neuropathy; (7) the risk of sciatic neuropathy in a patient who is positioned in a lithotomy position may be reduced if the degree of hip flexion is limited to 90°; and (8) it is important to document overall patient position (e.g., supine, prone, lateral, or lithotomy), position of arms, position of lower extremities, use of specific padding at the elbow or over the fibular head, specific positioning action(s) taken or used during a procedure as indicated by findings on a preoperative examination, and the presence or absence of signs or symptoms of peripheral neuropathy in the PACU.

A majority was not obtained for the following items: (1) gender as an important attribute to review in a focused preoperative history, (2) flexibility of the hamstring muscle group (for placing patients in a lateral or lithotomy position) as important for assessing a preoperative examination, (3) the degree of hip flexion for reducing the risk of femoral neuropathy in a patient placed in a lithotomy position, and (4) the type of leg holder used for a patient in a lithotomy position as an important attribute to document.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The original Advisory was developed by an American Society of Anesthesiologists (ASA)-appointed task force of 10 members, consisting of anesthesiologists in private and academic practices from various geographic areas of the United States and two methodologists from the ASA Committee on Standards and Practice Parameters.

The task force developed the original Advisory via a six-step process. First, they reached consensus on the criteria for evidence. Second, original published articles from peer-reviewed journals relevant to perioperative peripheral neuropathy were evaluated. Third, consultants who had expertise or interest in peripheral neuropathy and who practiced or worked in various settings (e.g., academic and private practice) were asked to do the following: (1) participate in opinion surveys on the effectiveness of various perioperative management strategies and (2) review and comment on a draft of the Advisory developed by the task force. Fourth, additional opinions were solicited from random samples of active members of the ASA. Fifth, the task force held an open forum at a national anesthesia meeting to solicit input on the key concepts of this Advisory.[†] Sixth, all available information was used to build consensus within the task force to finalize the Advisory (see appendix 1 in the original guideline document).

In 2009, the ASA Committee on Standards and Practice Parameters requested that evidence from two principal sources, scientific evidence and opinion-based evidence (see appendix 2 in the original guideline document), for this Advisory be updated. The update consists of an evaluation of literature that includes new studies obtained after publication of the original Advisory.

[†]Society for Ambulatory Anesthesia 14th Annual Meeting, Seattle, Washington, April 30, 1999.

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

Consultants who had expertise or interest in peripheral neuropathy and who practiced or worked in various settings (e.g., academic and private practice) were asked to do the following: (1) participate in opinion surveys on the effectiveness of various perioperative management strategies and (2) review and comment on a draft of the Advisory developed by the task force. Additional opinions were solicited from random samples of active members of the American Society of Anesthesiologists (ASA).

The task force held an open forum at a national anesthesia meeting to solicit input on the key concepts of this Advisory. All available information was used to build consensus within the Task Force to finalize the Advisory.

This Practice Advisory was approved by the ASA House of Delegates on October 20, 2010.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

Evidence was obtained from two principal sources: scientific evidence and opinion-based evidence.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Prevention of perioperative peripheral neuropathies in surgical patients

Potential Harms

The inappropriate use of padding (e.g., padding too tight) may increase the risk of perioperative neuropathy.

Qualifying Statements

Qualifying Statements

- Practice Advisories are systematically developed reports that are intended to assist decision making in areas of patient care. Advisories provide a synthesis and analysis of expert opinion, clinical feasibility data, open forum commentary, and consensus surveys. Practice Advisories developed by the American Society of Anesthesiologists (ASA) are not intended as standards, guidelines, or absolute requirements; their use cannot guarantee any specific outcome. They may be adopted, modified, or rejected according to clinical needs and constraints; they are not intended to replace local institutional policies.
- Practice Advisories are not supported by scientific literature to the same degree as standards or guidelines because of the lack of sufficient numbers of adequately controlled studies. Practice Advisories are subject to periodic revision as warranted by the evolution of medical knowledge, technology, and practice.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Staying Healthy

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

American Society of Anesthesiologists Task Force on Prevention of Perioperative [trunc]. Practice advisory for the prevention of perioperative peripheral neuropathies: an updated report by the American Society of Anesthesiologists Task Force on prevention of perioperative peripheral neuropathies. *Anesthesiology*. 2011 Apr;114(4):741-54. [79 references] [PubMed](#)

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2011 Apr

Guideline Developer(s)

American Society of Anesthesiologists - Medical Specialty Society

Source(s) of Funding

American Society of Anesthesiologists

Guideline Committee

American Society of Anesthesiologists Committee on Standards and Practice Parameters

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Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) and EPUB for eBook devices from the [Anesthesiology Journal Web site](#)

Print copies: Available from the American Society for Anesthesiologists, 520 North Northwest Highway, Park Ridge, IL 60068-2573.

Availability of Companion Documents

None available

Patient Resources

None available

NGC Status

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